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FLORA OF SAVANNAH THREATENED IN THE TAPAJ S RIVER BASIN, AMAZON: ETHNOBOTANY AS A CONSERVATION TOOL

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ABSTRACT

Riverside communities in the Tapajós Basin have vast traditional knowledge about uses of local flora. Such traditional knowledge transmitted from generation to generation is threatened by anthropic pressure on such ecosystems in the Amazon. The Juá Environmental Preservation Area (APA Juá) is one such area. The objective of this work was to characterize the traditional knowledge of a women and last group living on APA Juá, Santarém city, Pará state, through an Ethnobotanical study. From interviews with a semi - structured questionnaire, guided visit and herborization of the mentioned plant species, the method was configured, for later treatment of ethnobotanical variables by non - parametric analysis. Thirty - six ethnospecies useful for families were identified, distributed in 23 families and 34 genera. The species with the highest relative frequency of citations were Jurú (*C. icaco*), Piranga (*M. apiranga*) and Muruci (*B. crassifolia.*). Açaí (*E. oleracea*) was the specie with the highest Value of Use, suggesting the importance of conservation of it for sub existence and reproduction of these families over time. Among the medicinal plants, the boldo (*P. barbatus*), the lemon grass (*L. alba*), the guava (*P. guajava*) and the mint (*M. villosa*) stand out. Ethnobotanical research demonstrates that it is a good tool for popularizing and valuing traditional knowledge of riverside communities, but it is mainly used as a tool for socioenvironmental denunciation of savannas degradation in the Tapajós Basin.

KEYWORDS: Value of Use, Açaí, Murici, Medicinal Plants, riverside community, traditional knowledge, agroecosystems.

INTRODUCTION:

The Amazon region has many traditional populations in its territory, including indigenous and non-indigenous peoples, such as quilombolas (afro descendants), rubber tappers, riverside people, babaçú coconut crackers, among many others (ROCHA 2014). From the second half of the 1940s onwards, with the implementation of large developmental projects that did not fit the reality and needs of the region (OLIVEIRA et al. 2014), intense cultural, environmental and economic changes began to occur in the Amazon, generating reflections that until now are visible in regional public policies, where the interest of the appropriation of natural assets by private initiative continues to prevail, without taking into account the local actors' lifestyles and internal capacity to put into practice a development socially, economically and environmentally generating benefits for all equitably (LOCATELLI 2009). According to Lira and Chaves (2016), riparian peoples can be characterized as communities marked by socio-cultural and historical values of the Amazon region, engaging in agriculture, fishing, extractives, hunting and gathering according to their needs and available natural resources, maintaining thus ample relations of history, time and knowledge with the environment. Riverside communities are generally included in the Conservation Units (UCs), which are divided into two types: those of integral protection and sustainable use (BRASIL 2000), according to the National System of Nature Conservation Units (SNUC). The Environmental Protection Area (APA) allows traditional communities living in to continue to use and manage natural resources for their benefit, not degrading nature. In the city of Santarém, in the western state of Pará (eastern Amazon), the APA of Juá is an example of a protection area created in an urban border (ABREU 2015). However, it is included in a territory of increasing anthropic pressure of land occupation, many and illegal land invasions around the APA have begun to emerge, which has caused several environmental impacts, mainly in Lake Juá, which was used for traditional riverside people, affecting their ways of life and the accomplishment of fishing and agro-extractive activities. According to Flor and Barbosa (2015), the cultural habit of cultivating medicinal plants in traditional communities constitutes an important local resource for the collective health and environmental sustainability of the area, mainly because these populations do not have an effective health care and that be easily accessible, and have a close contact with nature and its plant species, knowing how to use them according to their needs (ELISABETSKY 1997). This tradition of learning to use plants, mainly medicinal, through experimentation, coexistence and oral conversations with older people is well represented in the literature, mainly in the works of Diegues (2000), Lima (2000), Allut (2001), Rodrigues 2002), Pizzolatto (2004) and Zambon and Agostini (2015), showing that these knowledges, transmitted orally between generations, are part of culture of these peoples, being intertwined with their life histories, identities and memories. Thus, the present work aimed to recover, register and disseminate the traditional knowledge of the residents of Juá community about the use, cultivation, extractivism and management of useful vegetable species to this population, through ethnobotanical survey and their non-parametric analyzes, contributing to the appreciation of traditional riverside knowledge. The hypothesis of work was that the ethnobotany studies on savannah communities can be a conservation tool of threatened environments as Lake of Juá.

METHODS:

The research developed on September of 2017 in Santarém (2 ° 24 '52 "S and 54 ° 42' 36" W), west of Pará state, a mesoregion of Low Amazon, on the right side of Tapajós River, at its confluence with the Amazon River, (ABREU 2015). The Juá Environmental Protection Area (APA) was created through the Municipal Law 19,206, of December 28, 2012, it has 126 hectares, which cover the Lake of Juá, Igarapé of Juá and their respective riparian forests. The community has an association, led by one of the interviewees, Mrs. Raimunda (64 years old). The research followed the guidelines of the Declaration of Helsinki and Tokyo for humans. For authorization of field work and in compliance with Provisional Measure 2186-2001 and Resolution No. 05 CGEN, the Instrument of Prior Consent (TAP) was signed by community leaders. The climate is of humid equatorial type (Ami) according to Köppen classification (1948), average annual temperature of 26ºC, with relative air humidity around 86% and annual rainfall with variations of 1,287 to 2,538 mm, (CAVALCANTE 2014; KEYS 2016). The rainy season occurs in the months of December to May, with monthly rainfall between 170 and 300 mm, and the dry season from August to November, with precipitation of 60 mm (BARLOW and PERES 2004). According to Chaves (2016), the regional climate is strongly influenced by the El Niño climate phenomenon, and when this occurs, the drought period is longer and more intense, which leaves vegetation coming vulnerable to forest fires. The soil is diverse and may be dystrophic yellow latosol (ROCHA 2014a) in the APA (secondary forest) regions, but it is also sandy where the beach community lives because of Tapajós River sediment deposit. The main economic activity is the artisanal fishing using nets, harpoons and reeds, made in small motor boats. The vegetation is a savannah type, composed of grasses and shrubby, herbaceous and arboreal dicotyledonous plants, the latter being susceptible to fires (SANAIOTTI & MAGNUSSON 1995; SCHOLES & ARCHER 1997). The interviews were conducted with 3 residents of Juá community, the only families who still lived in the area and the only one still maintain the knowledge. The questionnaire was semi-structured form adapted from Cavalcante (2014) containing social questions and about use of plants (ALBUQUERQUE et al. 2010) for food, therapeutic, energy and artisanal purposes. The botanical collections were carried out by touring-guided by the backyard, beach and community forest environments, with georeferencing of the collection points of plants, which were photographed, pressed and herborized (EMBRAPA 2008). The variables analyzed by means of non-parametric statistics (BIOESTAT PROGRAM 5.3 2007) were: 1. Relative Frequency of Citations (FRC) = FC / N according to LARDÍO E PARDO-DE-SANTAYANA(2008); where FC represents the number of informants who indicated the use of species and N expresses the total number of informants; 2. Value of Use (VU) according to Rossato et al. (1999); VU = (ΣU) / N; where ΣU is the sum of total number of uses

of particular plant species (U) and N, the total number of informants; 3. Fidelity level (FL): presented by Friedman et al. (1986), this index is used only for the medical use category and can be calculated by the formula: FL = (*Ip* / *Iu*) x 100%, where *Ip* represents the number of informants who mentioned the main use of the species and *Iu* total number of respondents who indicated the species for any purpose; 4. Rank Order Priority (ROP) refers to identification the order of priority medicinal species for that community and therefore important for management and conservation, calculated according to Albuquerque et al. (2010) by the formula ROP = FL x RP, where FL reflects the level of fidelity and RP describes the relative popularity, calculated by the ratio between the number of respondents who mentioned a given species, by the number of informants who cited the most indicated species.

RESULTS AND DISCUSSION:

Thirty-six ethno- uses for Juá community were cited and identified. These were grouped into 34 genera of 23 families (Table 1), among which, the most representative was Arecaceae, with 5 species, which is explained by the natural occurrence of these species in sandy environments, such as some palm trees as Açaí, Tucumã, Curuá and Najá. This taxonomic family also has the greatest species richness in the Chaves study (2016), which the author explains by the diversity of palm trees in the life of traditional communities, where they are used in food, house building, handicrafts and health care (GERMANO et al. 2014; SOUZA 2010). Another important family was Lamiaceae, which has taxa of great therapeutic importance, because they contain essential oils with aromatic and medicinal properties (Pinto et al. 2006; JUDD et al. 2009), such as those cited in this study; boldo, hortelãzinho and large leaf mint. These species were also observed in research by Di Stasi et al. (2002) and Alves and Povh (2013). An Anacardiaceae, was also an expressive family in this study, such data are in accordance with Almeida et al. (2014), these species being generally used for food and for treating diseases, such as mango, cashew and taperebá. Myrtaceae, was another family found in this work, which according to Santos et al. (2009), are species related to food and medicinal use, such as guava, pitomba and black olives. The number of species found in this study was lower in relation to the works of Braga (2013), which registered 90 useful species in an indigenous community in the region of Tapajós (Pará) and Rocha (2014), which identified 215 ethnospecies in the Extractive Reserve of Soure (Pará). Such a scenario can be explained by the low sample size of people interviewed. However, this scenario represents the exodus of riverside peoples from APA JUÁ to cities and therefore erosion of traditional knowledge, due to the impossibility of their traditional ways of staying and surviving. However, the number of plants cited in this study is still higher than those of Cavalcante (2013), which raised 33 multi-utility ethno-uses for Saracura Quilombo, floodplain ecosystem, Santarém-PA. Most of plants cited are exotic (53%) and 47% of plants are native. The most cited form of life was tree (64%), followed by herbaceous (8%). This research has a gender characteristic, where both interviewees and interviewers were women, where the perceptions of diseases and plants useful to them is due strictly to the female scenario lived under different generations. The plants cited by the residents were divided into seven categories, for food, medicinal, handicraft, construction, fuel, shading and fishing purposes. Thus, it is inferred that the primordial use of the plants is for the own use of the living people in Juá, helping them in their subsistence, and not using them to increase the family income. The category of use with the highest number of plant citations was food, with 23 plants (44%) as shown in Figure 1.

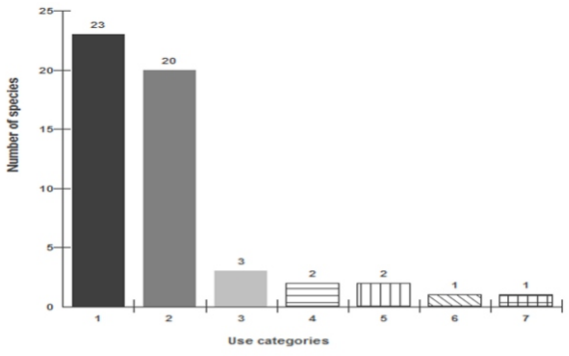

Figure 1. Number of plant species in seven (7) different categories of use * in Juá community, Santarém-PA, Brazil. * 1 - Food; 2 - Medicinal; 3 - Artisanal; 4 - Construction; 5 - Shading; 6 - Fuel; 7 - Fishery.

According to Amorozo (2002), the fact that most plants indicated in ethnobotanical studies serve for consumption shows that these plants contribute primarily to the continuity of local social groups, since they play the essential role of providing the food base of these residents, together with the animal protein from fish, in the case of riverside communities. These data are in accordance with the studies of Cavalcante (2014) and Zambon and Agostini (2015), revealing that the riverside communities tend to use more vegetal products for food purposes due to their low purchasing power (SEMEDO and BARBOSA, 2007). distance from these urban communities and the high cost of river transport, which hinders access to the city and the purchase of industrialized products (MARTÍNEZ et al. 2010). Associated with this, these populations have high productivity from other food sources, such as fish and wild animals for consumption (MCGRATH, 1991). The second most mentioned category of use was medicinal, with 20 plants (38%) used for this purpose. The high use of medicinal plants in riparian communities is also portrayed in Vásquez et al. (2014) and Santos-Silva and Oliveira (2016), which associates with the difficulty of community access to urban centers and the absence of a local health system. According to Elizabetsky (1997), such a scenario leads to a vast traditional knowledge about the use of plants for the cure of various diseases. This is also corroborated by the high incidence of medicinal plant cultivation in the area, made to improve the collective and individual health of the residents (SOUZA and PAULINO 2017), as well as the extractivism of these species from parts of secondary forest and the beach. The third most mentioned category was the artisanal (3 plants cited), being well below the first two, which alone occupy 82% of the mentions. The plants used for this use are the açaí (*Euterpe oleracea* Mart.), with the manufacture of utensils such as *paneiro* (basket) made of braided dry açaí straw and used to load food and other materials (SOUSA 2009)) and a fano (made with the scion of the açaízeiro, and used to "make fire", according to Ribeiro (1985). The manufacture of handicrafts and artifacts for domestic use and as ornaments, produced from plants originating in the Amazon region is portrayed in the study by Sousa (2009), which indicates that these practices, originally belonging only to indigenous populations, were transmitted and appropriated by populations, so that the latter came to learn and perpetuate this knowledge and ways of manufacturing typical of the Amazonian culture. The fourth category of plant use mentioned was relative to the construction, with only 2 species being used for this purpose. Açaí (*E. oleracea*) and the curuá (*Attalea attaleoides* (Barb. Rodr.) Wess. Boer) are widely cited in the literature, especially in the works of Silva (2005), Mendonça and Del Bianchi (2014), Brandão et al. (2015) and Chaves (2016), as two of the main palms used in construction in the region, especially for the covering of houses with the dry straw (leaves) of these plants. Black olives (*S. jambolanum*) and muruci (*B. crassifolia*) were cited in the APA JUÁ study for production of shade in the prairies of the community due to the large size of *S. jambolanum* (LABAKI et al. 2011). Muruci (*B. crassifolia*) is cited in Oliveira et al. (2017), as a fuel source, from charcoal with the plant's branches to start fire, mainly because of its high natural regeneration rate (IMANÃ-ENCINAS and DE PAULA 2003). The inhabitants cited as useful plants for the fishery, Najá (*M. maripa*). With the pulp of its fruit, baits are made to catch fish, but the use found for this fishery-related plant is the manufacture of tapiris and fishing instruments such as pari, matapi and paneiro, according to Oliveira et al. (2006) and Araújo et al. (2014).

Regarding the parts of plants used (Figure 2), the fruit was the most cited part with 20 quotations (40%). This strong number of mentions is due to the high incidence of fruit trees in the Environmental Preservation Area of Juá (APA), which produce a great diversity of edible fruits, a factor that per se is the importance of this APA. These results are agreement with Amaral and Neto (2008), Santos et al. (2009) and Chaves (2016). In the community of Juá, this wide use is reflected in the consumption *in nature*, or in the production of juices, wines, sweets, cakes and creams, being good sources of carbohydrate, lipids and vitamins (AGUIAR et al. 1980).

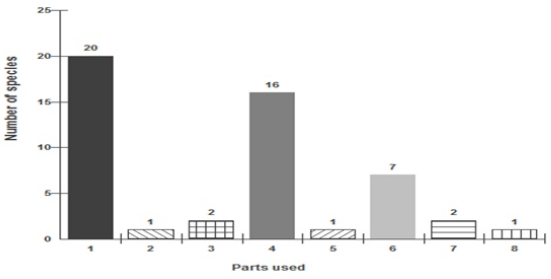

Figure 2. Number of plant species in relation to the parts used of these * in the riverside community of Juá, Santarém-PA, Brazil. * 1 - Fruit (a); 2 - Root; 3- Core; 4 - Leaf; 5 - Stretch; 6 - Bark; 7 - Branch; 8 - Seed.

Figure 2 shows the number of species cited by the plant used. The leaf as a useful part of the plants was quoted 16 times (32%). These data are in accordance with Santos et al. (2008), Alves and Povh (2013) and Baptistel et al. (2008), which is associated with the use of these for medicinal purposes by the greater concentration of active principles and the greater ease of collection (SANTOS et al. 2008). The bark had 7 indications (14%) of use, being generally for medicinal purposes. This category has been of great importance in Oliveira's dissertation (2016), which showed that this use of the bark is intertwined with a great knowledge of large wood species by both men and women. This is in accordance with the present textual discussion, in which the husband of Mrs. Raimunda, who is the person responsible for extracting from the secondary forest the bark of the species cited in the interviews for medicinal use, which shows that the latter knows well these trees in order to identify them in the forest. Regarding the therapeutic indications of the 20 plants listed as medicinal, the greatest use of disease treatment refers to stomach pain, with 6 mentions (17%).

The plants used for these purposes were: boldo (*P. barbatus*), lemon grass (*L. alba*), guava (*P. guajava*) and mint (*M. x villosa*). According to Figure 9 the various therapeutic indications and their relationship to the number of plant species are shown.

According to Jesus et al. (2009), plants with curative potential to the present day are the main alternatives for the treatment of diseases by traditional peoples, and these in riverside populations are mainly used for the treatment of gastrointestinal tract diseases, as shown by Moura (2012), Germano et al. (2014) and Gois et al. (2016), in his works carried out jointly with communities of Abaetetuba city, Pará state. Coelho-Souza et al. (2015) state that rural and riverside communities are more vulnerable to gastrointestinal diseases, mainly because they do not have services of water treatment, sewage and garbage collection. In the case of the APA Juá community, the discharge of untreated liquid effluents in the city affects the water quality of the Tapajós river, widely used by people living in the area, as well as the impacts caused by the enterprises Buriti and Salvação Residencial in the lake of Juá, who according to Júnior et al. (2015) brought various harms to the residents of the lake, including a 20% increase in cases of intestinal infections for people who used lake water for fishing, leisure and household chores. The Figure 3 demonstrated that Influenza, headache and wounding had each with 3 indications (9% individually); the species being indicated for influenza was açaí (*E. oleracea*), the Angola stick (*Piper divaricatum* G. Mey) and the pion-pajé (*Jatropha gossypiifolia* L); for headache, boldo (*P. barbatus*), holy grass (C*ymbopogon citratus* (DC.) Stapf.) and coramina (*Pedilanthus tithymaloides* (L.) Poit.) and for injuries, the guava *(P. guajava*), the jucá (Caesalpinia ferrea Mart. ex Tul.) and the Bahia pitomba (*Eugenia luschnathiana* (O. Berg) Klotzsch ex BD Jacks.).

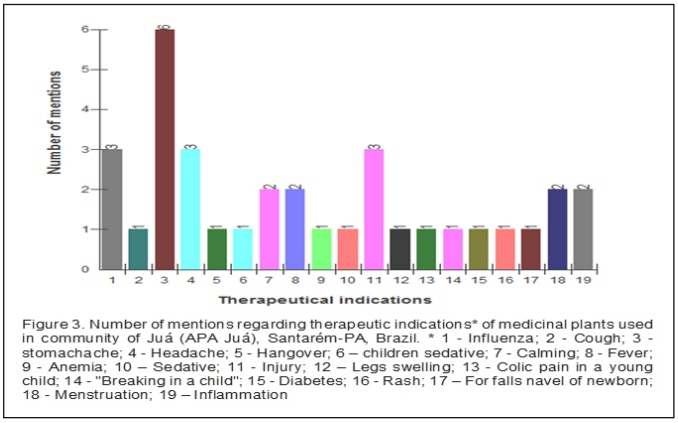

Figure 3. Number of mentions regarding therapeutic indications* of medicinal plants used in community of Juá (APA Juá), Santarém-PA, Brazil. * 1 - Influenza; 2 - Cough; 3 - stomachache; 4 - Headache; 5 - Hangover; 6 – children sedative; 7 - Calming; 8 - Fever; 9 - Anemia; 10 – Sedative; 11 - Injury; 12 – Legs swelling; 13 - Colic pain in a young child; 14 - "Breaking in a child"; 15 - Diabetes; 16 - Rash; 17 – For falls navel of newborn; 18 - Menstruation; 19 – Inflammation

These data are in agreement with Calvano et al (2004), Costa et al. (2013), from which coastal settlements in the Amazon are more susceptible to this disease of the respiratory system than from community-based forest environments, were also indicated for use as a sedative, fever, menstruation and inflammation, (*C. alucifera)* and lemon grass (*L. alba*), to combat fever, coramina and both for menstruation and inflammation, the barbatimão (*Ouratea hexasperma* (A. St.-Hil.) Baill var. Planchonii Engl.) and verônica (*Dalbergia subcymosa* Ducke).

The use of the lemon balm as a soothing agent is widely described in the literature, including in the ethnobotanical surveys of Moreira et al. (2002) and Vásquez et al. (2014) and the use of this same plant for fever is also listed in the work of Jannuzzi et al. (2011). The use of coconut as a tranquilizer is mentioned in the work of Anzaldo et al. (1982), although its most common uses are in the treatment of gastrointestinal diseases, such as diarrhea, or as a natural serum, according to the work of Freitas et al. (2015). However, the use of coramina to reduce fever was not found in the literature consulted, which leads to two hypotheses established by Badke et al. (2011): or that this species has healing properties, but not for the purposes cited, or does it actually have such healing practices, but because of the lack of studies demonstrating its therapeutic effects for these specific purposes, are scientifically stated. The use of species such as barbatimão and verônica have been demonstrated as common by women living in riverside communities within Environmental Protection Areas (MONTEIRO 2012), being used to control menstruation and to contain inflammations. Thus, these two plants are essential for the treatment of women's health also have studies that demonstrate their scientific healing abilities.

In accordance with Figure 4, regarding the forms of preparation, tea was the way of preparation made with the vegetable species that obtained the most quotations (13), corresponding to 18% of the total. This method is the most commonly cited in ethnobotanical studies of medicinal plants, especially in the works of Moreira et al. (2002), Franco and Barros (2006), Pasa (2011), Siviero et al. (2012) and Baptistel et al. (2014), for its ease and practicality to be done.

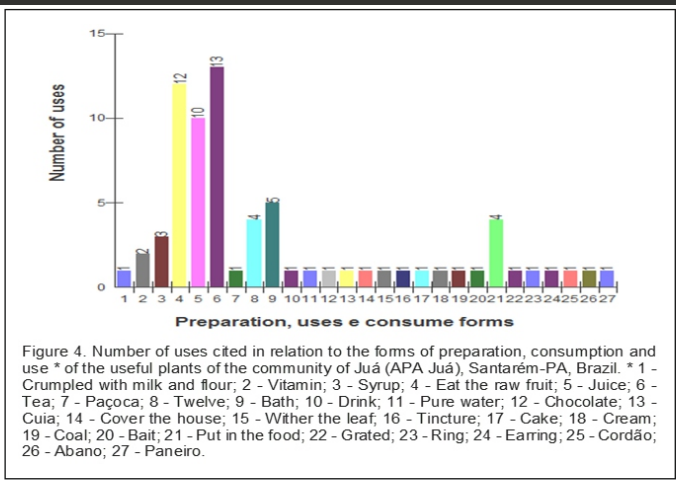

Figure 4. Number of uses cited in relation to the forms of preparation, consumption and use * of the useful plants of the community of Juá (APA Juá), Santarém-PA, Brazil. * 1 - Crumpled with milk and flour; 2 - Vitamin; 3 - Syrup; 4 - Eat the raw fruit; 5 - Juice; 6 - Tea; 7 - Paçoca; 8 - Twelve; 9 - Bath; 10 - Drink; 11 - Pure water; 12 - Chocolate; 13 - Cuia; 14 - Cover the house; 15 - Wither the leaf; 16 - Tincture; 17 - Cake; 18 - Cream; 19 - Coal; 20 - Bait; 21 - Put in the food; 22 - Grated; 23 - Ring; 24 - Earring; 25 - Cordão; 26 - Abano; 27 - Paneiro.

In addition, it is inferred that the preparation of teas in APA Juá occurs preferably by means of decoction, that is, by the boiling of the water together with the part of plants to be used (usually the harder parts, such as roots and peels). França et al. (2008) says that each plant species, can be a food, poison or medicine, this distinction being made only in relation to the dose, the route of administration and the purpose with which they are used. According to Figure 10 the methods of preparation, consumption and use of the plants are shown. The second and third forms of preparation and consumption are respectively the intake of raw fruit (17%) and juice (14%). As species of condiments, chicory and chives, which according to Murrieta (2001) are typical species of the Amazonian riverside diet, to improve the flavor of their food. Species used for the bath (5 mentions, 7% of the total) and syrup (3 records, 4%) were also reported. The syrup is listed in the survey of medicinal plants of Silva et al. (2006) as the most used form of herbal preparation for the treatment of influenza, while bath (topical), is the way to combat diseases of the respiratory system (including influenza).

The Relative Frequency of Citations (FRC) showed on Figure 5 is an ethnobotanical analysis that aims to identify species of major community importance through their citation numbers. Thus, the three species most cited for the community of Juá were jurú (*C. icaco*), Piranga (*M. apiranga*) and muruci (*B. crassifolia*) since they were cited by all the interviewees. The values of this index ranged from 0.333 to 1.0 in 36 species raised.

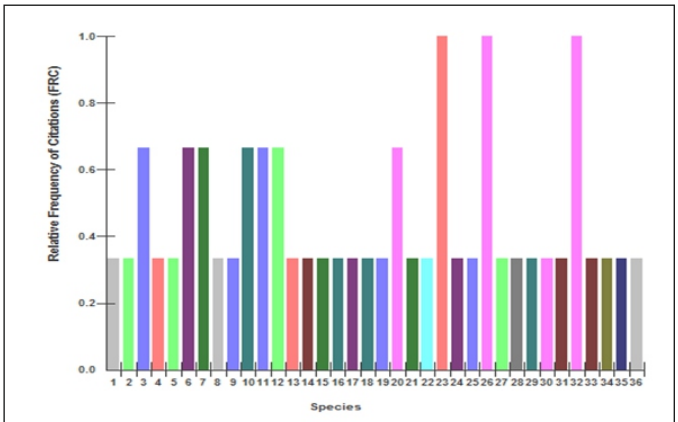

Figure 5. Citation Relative Frequency (FRC = FC / N) of 36 species* of plants in community of Juá (APA Juá), Santarém-PA, Brazil. * 1 - Avocado; 2 - Acai; 3 - Black olives; 4 - Banana; 5 - Barbatimão; 6 - Boldo; 7 - Cashew; 8 - Cane-mansa; 9 – Saint grass; 10 - Chives; 11 - Chicory; 12 - Coco; 13 - Coramine; 14 - Crajirú; 15 - Cupuaçú; 16 - Curuá; 17 - Lemon grass; 18 - Guava; 19 - Large leaf mint; 20 - Mint; 21 - White Japana; 22 - Jucah; 23 - Juru; 24 - Manga; 25 - Passion fruit; 26 - Muruci; 27 - Najá; 28 - Pau-de-Angola; 29 - Pajama; 30 - Muruci pepper; 31 - Roasted red pepper; 32 - Piranga; 33 - Pitomba da Bahia; 34 - Taperebá; 35 - Tucumã; 36 - Veronica.

These results can be explained by Phillips and Gentry (1993) on Ecological Appearance Hypothesis (HAE), proposed by ecologists in the 1970s, the plants most found in a locality, or the most apparent ones, will be the ones most used by this population, due to the greater probability of experimentation of these (ROCHA et al. 2014). Thus, it is inferred that jurú, Piranga and Muruci are quite easy to find in the community of Juá, mainly because they grow spontaneously in this type of Amazonian savannah environment. These species are also shown to be useful in the study of Chaves (2016) in an extractive reserve in western Para and in the work of Carneiro et al. (2010) in a marine extractive reserve of Pará coast. Other plants mentioned also had high FRC (0.6667), among them black olives (*S. jambolanum*), cashews (*A. occidentale*), chives (*A. fistulosum*) and chicory (*E. foetidum*) because they are grown in the houses of the interviewed, serving to be ingested, or next to the prepared foods. Among the medicinal plants, the boldo (*P. barbatus*), the mint (*M. x villosa*) and the coconut (*C.*

nucifera) are highlights. The Relative Frequency of Useful Species to the community of Juá obtained an average of 0.4537 and a standard deviation of 0.2131. There was low data variance, showing a certain homogeneity of traditional knowledge.

According to Phillips and Gentry (1993), Value of Use is a variable that measures the number of uses of a given species in relation to the total number of informants. Figure 6 shows the use values (VU) of the species sampled in the APA Juá savanna. The values ranged from 0.3 to 1.3, with açaí (*E. oleracea)* being the plant with the highest index (1.3), with food, medicinal, handicraft and construction uses.

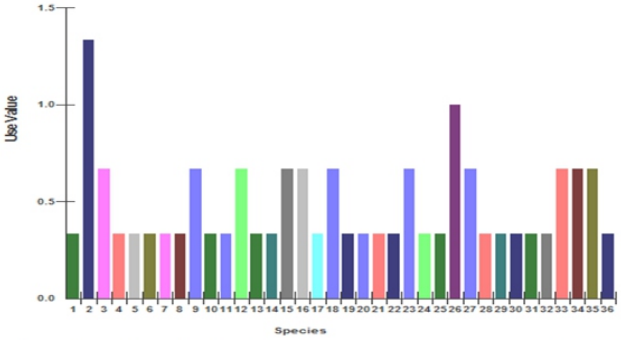

Figure 6. Value of Use (VU = ΣU / N) of 36 plant species in the community of Juá (APA Juá), Santarém-PA, Brazil. * the same species as in Figure 5.

According to Albuquerque et al. (2006), the VU can become an overestimate index if only one person knows various uses for such a plant, as in the case of this study. Açaí was also the species that showed the highest value of use in the study of Germano et al. (2014), and a high amount of uses in the study of Costa and Mitja (2010), which proves that this palm tree has multi functionalities that make it essential for the subsistence and ways of life of the local populations, being thus part of the Amazonian culture (Martins et al. 2005). The second species with the highest value of use identified (1.0) was muruci (*B. crassifolia*), with citations for use in food, in the treatment of diseases and as fuel (firewood). This plant also had high VU in the work of Oliveira (2016) and Rocha et al. (2013), and this fact is related because the *murucizeiro* being a very occurring plant in savannah and restinga environments. Like the açaízeiro, the murucizeiro should be considered as a key plant for conservation on the Amazon savannah ecosystem as APA DO JUÁ. The black olive (*S. jambolanum*), holy grass (*C. citratus*), coconut (*C. nucifera*), cupuaçú (*T. grandiflorum*), curuá (*A. attaleoides*), guava (*P. guajava*), juru, najá (*M. maripa*), Bahia pitomba (*E. luschnathiana*), taperebá (*Spondias mobbing L.*) and Tucumã (*A. aculeatum*), also presented significant values of use. The average value of use for the plants raised was 0.4815, and a standard deviation of 0.2316, which demonstrates a certain heterogeneity of the use of plants from traditional knowledge. Another variable studied was the Loyalty Level (FL), which aims to evaluate the consensus of therapeutic indications that these species possess. In this work, the Loyalty Level (FL) ranged from 33.333% to 100% according to Figure 7, with most medicinal plants (17 species) with the maximum fidelity value (100%). Boldo (*P. barbatus),* was the species that obtained the highest level of fidelity indicating that according to Schardong and Cervi (2000) and Costa et al. (2017), it is being used by all respondents for the same therapeutic purposes.

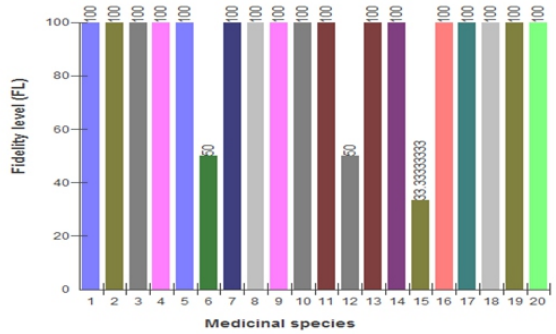

Figure 7. Loyalty level (FL = (Ip / Iu) x 100%) of 20 species * of medicinal plants found in the community of Juá (APA Juá), Santarém-PA, Brazil. * the same species as in Figure 5.

In accordance with Figure 7, two species had FL equal to 50%, being the coconut (*C. nucifera*) and the mint (*M. x villosa*) their representatives. The coconut was mentioned once as soothing and the mint for belly pain as a child. Only one species (*C. icaco*) had the lowest Loyalty Level (33.333%), where only one of the interviewees pointed out the species for the cure of diabetes. As for the results of the Priority of Ordering (ROP) at Figure 8 they ranged from 33,333 to 66,667. The species that possessed the highest ROP was the Boldo (*P. barbatus),* being coated as a priority plant in the sub existence of these residents of Juá beach on Tapajós Basin. The results of ROP in this study had higher values than those pointed out by Cavalcante (2014) in ethnobotanical studies in floodplain community (Santarém city), which found ROP between 0.05 and 0.75. This fact is related to the lower sample size of interviewees in this study.

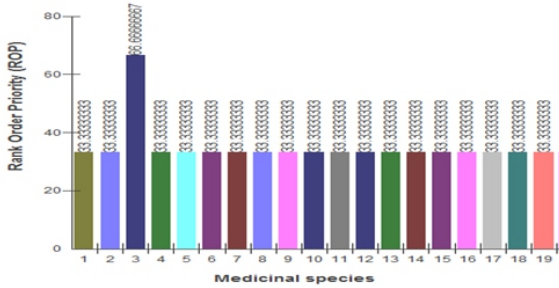

Figure 8. Rank Ordering Priority (ROP = FL x RP) of 20 species * of medicinal plants found in Juá community (APA Juá), Santarém-PA, Brazil. * Species corresponding to the numbers are in Figure 5.

The wealth of traditional knowledge about the local flora of families living in the beach of Juá proves the resistance of these to all anthropic pressures of surroundings, that now culminated with destruction of Jua's lake, source of artisanal fishing, the main one economic activity. Species of plants such as Juru (*C. icaco), P*iranga (*M. apiranga*) and Muruci (*B. crassifolia*.) are important in the conservation processes of this APA, as well as the açaí (*E. oleracea*) and boldo (*P. barbatus*), due to the high value of use and priority of these species for the riverside families. Ethnobotany becomes here as well as an academic instrument in the process of popularization and valorization of traditional knowledge, but also a tool for social and environmental denunciation about degradation in APA of Juá, Amazon.

Table 1
List of plant species useful for community of APA Juá, Santarém city, Pará state, with popular name, scientific name, family, life habitat, use of plant, therapeutically indications, the parts of plant used and the number of collector or registration Herbarium.

Nº	Popular name	Scientific Name	Family	Life habitat	Use	Therapeutical Indication	Parts of plants used	Number Collector/ registration
1	Abacate	*Persea americana* Mill	Lauraceae	Tree	Nourish	x	Fruit	Souza, B.C.O.Q 7
2	Açaí	*Euterpe oleracea* Mart.	Arecaceae	Tree	Nourish, medicinal, artesanal e de construction	Cold, Couch	Fruit, root, seed, bark	Souza, B.C.O.Q 7
k3	Azeitona preta	*Syzygium jambolanum* (Lam.) DC	Myrtaceae	Tree	Nourish, shade	x	Fruit	Souza, B.C.O.Q 7
4	Banana	*Musa* spp.	Musaceae	Tree	Nourish	X	Fruit	Souza, B.C.O.Q 7
5	Barbatimão	*Ouratea hexasperma (A. St.-Hil.) Baill var. Planchonii* Engl.	Ochnaceae	Tree	Medicinal	Menstruation, inflammation	Bark	Souza, B.C.O.Q 7

6	Boldo	*Plectranthus barbatus* Andrews	Lamiaceae	Tree	Medicinal	Stomachache, headache,	Leaf	Souza, B.C.O.Q 7
7	Cajú	*Anacardium occidentale* L.	Anacardiaceae	Tree	Nourish	X	Fruit, nuts	Souza, B.C.O.Q 7
8	Cana-mansa	*Costus spicatus (Jacq.)* Sw.	Costaceae	herbaceous	Medicinal	Sedative for children	Leaf	Souza, B.C.O.Q 7
9	Capim santo	*Cymbopogon citratus* (DC.) Stapf.	Poaceae	herbaceous	Medicinal, nourish	headache	Leaf	Souza, B.C.O.Q 7 Souza, B.C.O.Q 7
10	Cebolinha	*Allium fistulosum* L.	Alliaceae	Herbaceous	Nourish	X	Leaf	Souza, B.C.O.Q 7
11	Chicória	*Eryngium foetidum* L.	Apiaceae	herbaceous	Nourish	X	Leaf (mature)	Souza, B.C.O.Q 7
12	Coco	*Cocos nucifera* L.	Arecaceae	Tree	Nourish, medicinal	sedative	water, fruit, pulp	Souza, B.C.O.Q 7
13	Coramina	*Pedilanthus tithymaloides* (L.) Poit.	Euphorbiaceae	herbaceous	Medicinal	Fever, headache	Leaf	Souza, B.C.O.Q 7
14	Crajirú	*Fredericia chica (Bonpl.)* L.G. Lohmann	Bignoniaceae	Tree	Medicinal	Anemia	Leaf	Souza, B.C.O.Q 7
15	Cupuaçú	*Theobroma grandiflorum (Willd. ex Spreng.)* K. Schum	Malvaceae	Tree	Nourish, artisanal	X	seed, bark, pulp	Souza, B.C.O.Q 7
16	Curuá	*Attalea attaleoides (Barb. Rodr.)* Wess. Boer	Arecaceae	herbaceous	Construction, nourish	X	Bark, fruits	Souza, B.C.O.Q 7
17	Erva cidreira	*Lippia alba* (Mill.) N.E.Br.	Verbenaceae	Herbaceous	Medicinal	Sedative, stomachache, fever	Leaf	Souza, B.C.O.Q 7
18	Goiaba	*Psidium guajava* L.	Myrtaceae	Tree	Nourish, medicinal	hurt	fruit	Souza, B.C.O.Q 7
19	Hortelã large leaf	*Plectranthus amboinicus* (Lour.) Spreng.	Lamiaceae	Herbaceous	Medicinal	swelling in the legs	Leaf	Souza, B.C.O.Q 7
20	Hortelãzinho	*Mentha x villosa* Huds.	Lamiaceae	herbaceous	Medicinal	Children stomachache;	Leaf	Souza, B.C.O.Q 7
21	Japana branca	*Eupatorium triplinerve* Vahl	Asteraceae	herbaceous	Medicinal	Children sedative	Leaf	Souza, B.C.O.Q 7
22	Jucá	*Caesalpinia ferrea Mart. ex Tul.*	Fabaceae	Tree	Medicinal	hurt	Bark	Souza, B.C.O.Q 7
23	Juru	*Chrysobalanus icaco* L.	Chrysobalanacea e	Tree	Nourish, medicinal**	Diabetics	Fruit, bark, leaf, pulp	HSTM10176
24	Manga cuité	*Mangifera indica* L.	Anacardiaceae	Tree	Nourish	x	Fruit	Souza, B.C.O.Q 7
25	Maracujá	*Passiflora edulis Sims*	Passifloraceae	shrub	Nourish	x	Fruit	Souza, B.C.O.Q 7
26	Muruci	*Byrsonima crassifolia* H.B.K	Malpighiaceae	Tree	Nourish, Shade, fuel	x	Fruit, bark	HSTM10178
27	Najá	*Maximiliana maripa* (Aublet.) Drude	Arecaceae	Tree	Nourish, for fishing	x	Fruit, Fruit pulp, bark	Souza, B.C.O.Q 7
28	Pau-de-Angola	*Piper divaricatum* G. Mey.	Piperaceae	Tree	Medicinal	Cold	Leaf	Souza, B.C.O.Q 7
29	Pião Pajé	*Jatropha gossypiifolia* L.	Euphorbiaceae	Tree	Medicinal	Cold	Leaf	Souza, B.C.O.Q 7
30	Pimenta “muruci”	*Capsicum chinense* Jacq.	Solanaceae	Schrub	Nourish	x	Seed, fruit	Souza, B.C.O.Q 7
31	Pimenta "ova de aruanã"	*Capsicum annum var. glabrisculum* (Dunal) Heiser & Pickersgill	Solanaceae	Schrub	Nourish	x	Fruit	Souza, B.C.O.Q 7 Souza, B.C.O.Q 7
32	Piranga	*Mouriri apiranga* Spruce	Melastomataceae	Tree	Nourish	x	Fruit	HSTM10177
33	Pitomba da Bahia	*Eugenia luschnathiana* (O. Berg) Klotzsch ex B. D. Jacks.	Myrtaceae	Tree	Nourish, medicinal	Stomachache, hurt	Bark, fruit	Souza, B.C.O.Q 7
34	Taperebá	*Spondias mombin* L.	Anacardiaceae	Tree	Nourish, medicinal	Assadura, ferimento, Stomachache	Pulp, fruit, bark	Souza, B.C.O.Q 7
35	Tucumã	*Astrocaryum aculeatum* Meyer	Arecaceae	Tree	Nourish, artisanal	x	Fruit, seed	Souza, B.C.O.Q 7
36	Verônica	*Dalbergia subcymosa* Ducke	Fabaceae	Tree	Medicinal	Menstruation, inflammation	Bark	Souza, B.C.O.Q 7

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